



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/634,556	08/07/2000	Shyh-Ming Chang	64,600-065	3972

7590

12/31/2002

Tung & Associates  
838 W Long Lake Road  
Suite 120  
Bloomfield Hills, MI 48302

EXAMINER

PHAM, THANHHA S

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 12/31/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/634,556

Applicant(s)

CHANG ET AL.

Examiner

Thanhha Pham

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) 17-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

Art Unit: 2813

## **DETAILED ACTION**

**This Office Action responses to Applicant's Response on Paper No. 6 dated 10/21/02.**

### ***Election/Restrictions***

1. This application contains claims 17-24 drawn to an invention nonelected without traverse in Paper No. 4 and 5. A complete reply to the final rejection must include cancelation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-6 and 14-16 rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's Admitted Prior Art (APA) in view of Chang et al [US 5,393,697] as submitted in IDS.

APA, specification pages 10 and figs 1A-1F, substantially discloses the claimed method for forming electrically conductive bumps on a wafer comprising steps of:

Art Unit: 2813

providing a wafer (10, fig 1A) having an active surface (12), a plurality of conductive elements (14) formed on the active surface, and a passivation layer (16) insulating said plurality of conductive elements from each other;

sputter depositing a first metal layer (18, e.g. Al, fig 1B) on top of said plurality of conductive elements and said passivation layer;

printing a plurality of bumps (22, fig 1D) of an insulating material each on top of one of said plurality of conductive elements;

heating said plurality of bumps (specification page 7);

sputter depositing a second metal layer (24, e.g. Al) on top of said plurality of bumps and said first metal layer; and

patterning by photographic method and removing said first and second metal layer in areas between said plurality of bumps.

APA fails to teach heating said plurality of bumps at a temperature of at least 100°C. However, the range temperature of annealing said plurality of bumps is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. See Chang et al, col 5 lines 26-52, as an example to shows annealing to cure the bump at a temperature of 160°C. Therefore, it would have been obvious for those skilled in the art to choose the annealing temperature of at least 100°C to heat the plurality of bumps in the process of APA as a optimized parameter to cure the plurality of bumps.

With respect to claims 1-2 and 6, range of annealing temperature, ranges of spacing between said plurality of conductive elements and range of the first metal

Art Unit: 2813

thickness are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*See also In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

With respect to claim 3, Al and Cu are conventional material for forming the conductive elements on the active surface of substrate for forming interconnection path of a device. See Chang et al as an example.

Art Unit: 2813

With respect to claim 16, removing the first and second metal layer by photolithographic and wet etch method is conventional to those skilled in the art. See Chang et al as an example.

3. Claims 7-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over APA in view of Chang et al as applied to claim 1 above, and further in view of Estes et al [US 6,189,208] or Farnworth et al [US 5,925,930].

APA in view of Chang et al substantially discloses the claimed method except teaching using stencil printing to print said plurality of bumps.

Estes et al teaches stencil-printing as an advantage technique to print plurality of bumps due to its ease of control and precision.

Farnworth et al teaches stencil-printing as an advantage technique to print plurality of bumps due to its simpler process with low cost.

It would have been obvious for those skilled in the art to modify the process of APA in view of Chang et al by incorporating stencil-printing technique, as taught by Estes et al or Farnworth et al, to form the plurality of bumps with a simple and low cost process having a better of control and precision.

With respect to claims 10 and 11, ranges of width and thickness of said bumps are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted *In re Aller* 105 USPQ233, 255 (CCPA), the selection of reaction parameters such as temperature and concentration would have been obvious. See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ

Art Unit: 2813

*308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

### ***Response to Arguments***

4. Applicant's arguments filed 10/21/02 have been fully considered but they are not persuasive.

Contradictory to Applicant's argument on pages 2-4 that "the applicant's own prior art disclosure does not disclose a method in which a plurality of bumps are printed", Applicant's Admitted Prior Art (APA) discloses the method in which the plurality bumps are printed by photolithography process. According to APA, when the plurality bumps 22 (fig 1D) from the polymeric material layer 20 (fig 1C) by photolithographic process, those skilled in the art must recognize that the bumps 22 of APA are formed by using photoresist masks wherein shapes of the bumps 22 are printed from the shapes of photoresist masks. The plurality of bumps 22 are, therefore, printed each on top of one of the plurality of conductive element 14 (fig 1D). Notice that, Merriam Wester's Collegiate Dictionary, the 10<sup>th</sup> edition, "print" means "produce printed matter" or "display on a surface for viewing". In this case, the bumps 22 are displayed on each top of conductive element 14 for viewing and APA process produces a printed matter – shape of the bumps 22 from the photoresist masks.

5. Regarding to Applicant's argument on pages 5-8, Applicant argues that "since the Estes et al or Farnworth et al 's printing electrically conductive polymer bumps is conducted on flip-chips, while the present invention printing method of insulating

Art Unit: 2813

polymeric bumps on a wafer (wafer level packaging process) is distinctly different technological area, there can be no motivation to combine the references together in arriving the present invention method". The argument is not persuasive because the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, APA discloses printing a plurality of bumps of an insulating material each on top of one of the plurality of conductive elements except using the stencil-printing to print said plurality of bumps. However, Estes et al and Farnworth recognize the advantage of using stencil-print to form plurality of bumps on conductive elements with low cost and better control and precision. Furthermore, Estes et al discloses stencil-printing can be apply to either insulating material (electrically insulating adhesive paste formed of polymer) or conductive material (electrically conductive polymer). It would have been obvious for those skilled in the art to combine the teaching of Estes or Farnworth to using the stencil-printing in the process of APA with the advantages as being mentioned above. Unobviousness can not be established by attacking references individually when rejection is based on combination of references. See *In Re Young* 159 USPQ 725 (1968) and *In re Keller* 208 USPQ 871 (1981).



Art Unit: 2813

***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Art Unit: 2813

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham  
December 26, 2002

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800